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RESEARCH ARTICLE

Survey on Identify the Agricultural Diseases Using Image Processing and Soft Computing Techniques

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ABSTRACT

The agricultural land mass is more than just being a feeding sourcing in today's world. Agriculture productivity defines the economy of India in a great manner. So, in plants, disease detection plays a vital role in agriculture field. Automatic disease detection approaches are used for detecting plant diseases during the initial stages. To identify the agricultural diseases using digital image based on various features like color, textures and shape. Research firm currently doing a research to detect and diagnosis agricultural diseases based on digital image. This survey provides a better understanding of the soft computing techniques and image processing used for researcher and farmers to identify the agricultural diseases. This survey highlights several diseases of agricultural plants like rice, apple, cucumber, graphs, banana, cherry, wheat and sugarcane. And also this analysis work provides the comparison analysis of different research techniques in terms of their merits and demerits along with numerical analysis.

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Introduction

In our country, Agriculture is a backbone [1]. Good crops are selected by farmers for their farm. Anyhow, standard manufacturing and maximum profit based crop cultivation involves scientific knowledge. Technical assistance are required for developing this scientific knowledge. Disease management requires highly powerful supervision system especially for continually recurring crops. Effective monitoring leads to significant production and profit. In agricultural applications, highly powerful method of detection involves the use of image processing, which are used for detecting illness by processing plant pictures [2]. For developing agriculture, these techniques may by used with some assistance. Disease identification by human vision is restricted due to the microscopic nature of the primary symptoms.

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These techniques requires more time and are not interesting. So, there is a need to have a system which acknowledges mechanically, does classification and detects disease symptoms quantitatively.

Traditional plantae kingdom's gries process physical performance is shown as inventory disease waste with respect to industrial sickness [3]. Symptoms are computed using available proofs [3]. Microorganism causes illness and it corresponds to an agent which is inflicting illness. It is tough to handle illness management. On plant stems, fruits or on plant leaves, there exist various diseases. Study of exact se quantification of visually diagnosed traits, pests and diseases are restricted due to visual patterns difficulties [4]. In majority cases, on plant stems or leaves, diseases are detected. In crops cultivation booming, important roles are played by illness symptoms, disease searching, leaves and plants recognition. For classifying, recognizing and finding crops illness, computer vision system development is necessary which avoids human interference. An unbiased

solution for illness infection and its valuation is necessary [5]. Automatic systems are used for avoiding divine consultation by Farmers. Huge crop fields can be monitored using this automatic detection system. A highly significant topic of analysis is leaf disease detection and disease can be noticed automatically by symptoms on plant leaves. Major role is played by image processing in this automatic system.

Plant pathologies are detected using different methods [6]. Visible symptoms are not shown by some diseases or those appear only when it is too late to act. So, it is required to have powerful microscopes based sophisticated analysis techniques. In few cases, in electromagnetic spectrum parts, symptoms are detected which can be detected by human vision. Remote sensing method usage is a common technique used in these situations and it explores multi and hyperspectral image captures. For achieving its goals, digital image processing tools are employed in these methods. However, due to their many peculiarities and to the extent of the literature on the subject, they will not be treated in this work.

The main goal of this research work is to analyse the various research techniques that attempts to ensure accurate and reliable detection of agricultural disease happening on the plants. This is done by analyzing and studying various research techniques introduced by different researchers. And also this research work ensures that studying of different research studies in terms of their working procedures, merits and demerits.

Analysis of Image Processing and Soft Computing Techniques for Predicting Agricultural Disease

Du et al [7] developed a new methodology for recognize the plant species using leaf shape feature. First, gather leaf data from a real-world context for this research. The Move Median Centers (MMC) hyper sphere classifier was used for classifying the leaf database based on digital morphological features. Finally, real-time tests were used to assess the suggested method's efficiency and effectiveness.

Huang et al [8] studied the various applications of artificial neural network to detect phalaenopsis easing diseases. They looked at the two key characteristics of colour and texture, as well as image processing techniques that may be used for detecting as well as classifying phalaneposis seeding illnesses. Bacterial Soft Root (BSR), Phytophthora Black Root and Bacterial Brown Spot (BBS) are Phalaneposis seeding diseases (PBR). The lesion areas of BSR, BBS and PBR of BSR, Pof phalaenopsis seeding. To assess textural features and detect lesion sites using the Gray Level Co-occurrence Matrix (GLCM). The colours Red, Green, and Blue are used for classifying different types of lesions. The texture and colour features were classified using a back propagation neural network. These algorithms correctly recognized and categorized 89.6 percent of the time. The capability of these methods only detection and without classification to an accuracy of 97.2%.

Chakraborty et al [9] said that the value of computers expert systems over human experts in India was discussed in this study, as well as the factors or qualities that were considered when developing the computerised expert system. This work develops a taxonomy for agricultural production expert systems. This report also covers the four computerised expert systems for crop production that are now accessible in India.

Wang et al [10] developed new system to automatic detection of crop diseased based on leaf images using image segmentation by colour features. Cucumber leaf image was utilised as an input image in this project. This project also included an analysis of the RGB and HSI colour models, as well as the use of feature map technology to merge the RGB and HSI colour models. Crop diseases were detected using image segmentation. In comparison to existing methods, the proposed method has a high efficiency.

Camargo et al [11] used color features to evaluate the visual symptoms. HSI model transformation, HI3aI3b colour transformation, and I1I2I3 colour transformation were used to convert RGB colour image features. The histogram, thresholding method, segmentation methods, nearby pixel extraction methods, and grading methods were all investigated as image processing algorithms.

Cui et al [12] developed new image processing methods for quantitatively detecting soybean rust from multi spectral images. Colour feature HSI model (Hue Saturation Intensity) was selected. To segment diseased areas from plant leaves, a threshold-based segmentation algorithm was applied. To determine the severity of soybean rust using the two metrics Ratio of Infected Area (RIA) and Rust Color Index (RCI). Soybean leaf pictures with varying rust severity levels and quantity were gathered and evaluated. The proposed method provided better result compared with existing methodologies.

Gurjar et al [13] developed new system to detect the disease of cotton leaves based on eigen feature regularization and extraction technique. Using the eigen vector method, extract the feature vector (scatter matrix) from a cotton leaf image. Various illnesses, such as fungal infections and leaf crumple, were used to breakdown the scatter matrix into various subspaces. This project made use of thousands of sample photos. All of the photos were compared to the original and infected versions. This method gave more precision.

Abu-Naser et al [14] developed an expert system for plant disease diagnosis. This expert system was consists of two different methods of plant diagnosis. The first way was descriptive, and the second was pictorial depiction. The user was given information such as diagnostics and treatments using the descriptive method. The user was given pictorial representations of information using the graphical representation method. This strategy improves the performance of existing expert systems.

Al-Hiary et al [15] created a software prototype model for detecting and classifying plant leaf diseases automatically. There are four primary phases in the model that has been established. The initial step was to find the pixels that were primarily green. In the second stage, these pixels were mashed using Otsu's approach to calculate specified threshold values. Most green pixels were masked in

the third phase. The fourth stage was to entirely eliminate pixels with 0 red, green, and blue values from the boundaries of the infected object. The proposed technique achieves a 20 percent speedup over existing approaches with a precision of 83 to 94 percent, a more accurate answer, and a precision of 83 to 94 percent.

Anami et al [16] developed new methodology to identify and classify the normal and affected agriculture / horticulture produced based on colour and texture feature. Using a combination of colour and textural features, diagnose agriculture / horticulture diseases. Using a neural network classifier, classify agriculture and horticulture illnesses. When compared to previous approaches, the suggested system's accuracy is increased by combining colour and texture features.

Kulkarni et al [17] developed new methodology to detect plant diseases using image processing techniques and artificial neural network (ANN). The photos were captured initially, and the low frequency component was removed using the gabor filtering approach. The colour and texture features were used to extract the feature using the segmentation method. The image was classified into healthy and unhealthy using ANN. The proposed methodology was 91 percent more accurate than other existing approaches.

Revathi et al [18] developed software prototype model to classification of cotton leaf spot diseases using image processing edge detection techniques. The initial step was using a mobile device to take symptoms of cotton leaf spot photos and then enhancing them with normalisation and filtering algorithms. Using the segmentation method, the RGB colour feature was extracted. Using homogenise approaches like the Sobel and Canny filter, extract the edge features. Classifier used to classify the cotton leaf spot diseases and finally provided information to help the farmer to take superior decision.

Husin et al [19] studied on plant chili disease detection using image processing techniques. To determine the health state of each plant in the field, an image of a chilli leaf was collected and processed. Chemicals were sprayed to all plants on a regular basis to determine their health status. The proposed technique proved to be beneficial in supporting farmers in monitoring large planted areas. The proposed method involves inspecting leaf attributes for early diagnosis of chilli illnesses.

Vijayakumar et al [20] used digital image processing techniques to develop a new way for identifying foot rot illnesses in the vellai kodi type of betel vine plants. Images of betel vine plants were taken with a high-resolution digital camera and saved in JPEG format. Using the RGB encoding procedure, the RGB components of images were separated. All sample leaves' mean and median values were computed and compared to test leaves' mean and median values. The comparison resulted in sample photos that were either diseased or not. Finally, this examines how to successfully recognise foot root illnesses. This method outperformed the previous methods in terms of accuracy.

Comparison of Plant Disease Detection Techniques

In this section, comparison analysis of plant disease detection techniques are done in terms of their merits and demerits.

Table 3.1. Comparison analysis of image processing and soft computing techniques

S.No	Author	Method	Merits	Demerits
1	Du et al (2007)	Move Median Centers (MMC) hypersphere classifier	More robust Improved efficiency	More computation time required
2	Huang et al (2007)	back-propagation neural network classifier	Increased accuracy level Better detection capacity	More processing time required
3	Chakraborty et al (2008)	Analysis of computerized expert systems	Many efficient computation techniques Increased accuracy level	Need more training samples for better accuracy
4	Wang et al (2007)	morphological method	Accurate segmentation outcome Reduced error rate	Increased computational complexity
5	Camargo et al (2009)	Image processing based method	Able to find disease regions even with more intensities More accuracy level	More computational overhead
6	Cui et al (2010)	fast manual threshold-setting method	Accurate detection of different rust level of plant Better efficiency	More time complexity
7	Gurjar et al (2012)	Eigen feature Regularization and Extraction Technique	Efficient dimensionality reduction outcome Increased accuracy level	Requires more training samples for accurate evaluation
8	Abu-Naser et al (2010)	Descriptive and graphical representation method	Better positive impact More accuracy level	More processing overhead
9	Al-Hiary et al (2011)	OTSU method	Better precision rate Increased speedup	Cannot handle large volume of data
10	Anami et al (2011)	Neural network classifier	Less expensive Accurate detection rate	More computational complexity
11	Kulkarni et al (2012)	Artificial neural network	Increased computational efficiency Better accuracy level	More processing overhead
12	Revathi et al (2012)	HPCCDD Proposed Algorithm	Lesser time complexity Increased accuracy level	Increased computational complexity
13	Husin et al (2012)	Plant Chili Disease Detection	Inexpensive system Lesser computational complexity	More time complexity
14	Vijayakumar et al (2012)	Foot rot disease identification	Increased accuracy level Increased accuracy level	More processing overhead

Numerical Analysis

In this section comparison analysis of the research work conducted in matlab simulation environment from which it is proved that different research techniques can ensure better and efficient detection of plant diseases. Here comparison analysis is made in terms of accuracy, sensitivity and specificity metrics. Comparison is made between the research techniques Foot Rot Disease Identification Method (FRDIM), Plant Chilli Disease Detection Method (PCDDM) and HPCCDD Method.

Table 4.1. Comparison of proposed and existing approaches

Methods	Accuracy (%)	Sensitivity (%)	Specificity (%)
FRDIM [20]	89.20	88.9	90
PCDDM [19]	97.1	91.9	98
HPCCDD [18]	92.1	88.8	91.6

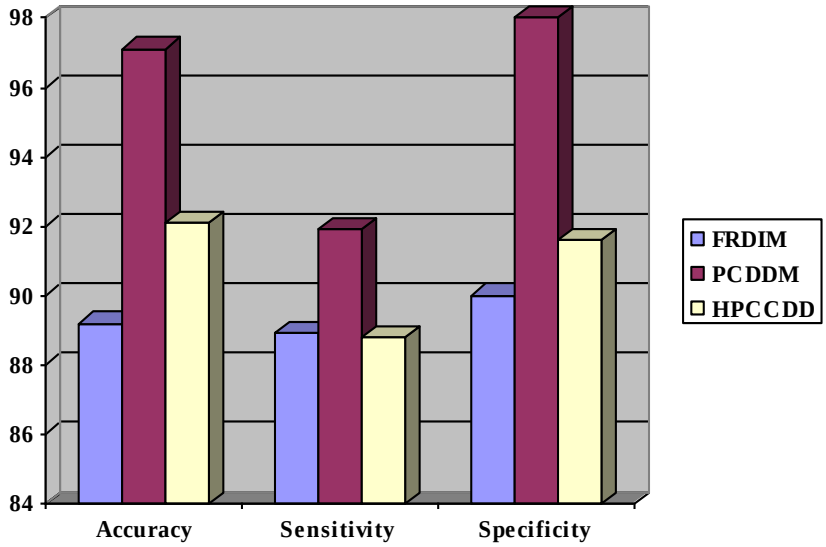

Figure 1. Numerical comparison

In figure 1, comparison analysis of the research techniques are made in terms of accuracy, sensitivity and specificity. From this analysis it is proved that existing methodology FRDIM tends to provide more accurate outcome in the plant disease detection outcome.

Conclusion

This paper present a survey on using image processing and soft computing techniques for identify the agricultural diseases Agricultural illnesses can be detected using techniques such as edge based segmentation, threshold based segmentation, region based segmentation, matching methods, clustering techniques, preprocessing techniques, filtering techniques, and feature extraction techniques. In this survey also explain the concept of soft computing techniques are neural network, machine learning algorithm, back propagation networks, Bayesian networks, support vector machine and regression analysis. It has been used for diagnosis the agricultural diseases.

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